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# Trends in health inequalities in 27 European countries

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Unfavorable health trends among the lowly educated have recently been reported from the United States. We analyzed health trends by education in European countries, paying particular attention to the possibility of recent trend interruptions, including interruptions related to the impact of the 2008 financial crisis. We collected and harmonized data on mortality from ca. 1980 to ca. 2014 for 17 countries covering 9.8 million deaths and data on self-reported morbidity from ca. 2002 to ca. 2014 for 27 countries covering 350,000 survey respondents. We used interrupted time-series analyses to study changes over time and country-fixed effects analyses to study the impact of crisis-related economic conditions on health outcomes. Recent trends were more favorable than in previous decades, particularly in Eastern Europe, where mortality started to decline among lowly educated men and where the decline in less-than-good self-assessed health accelerated, resulting in some narrowing of health inequalities. In Western Europe, mortality has continued to decline among the lowly and highly educated, and although the decline of less-than-good self-assessed health slowed in countries severely hit by the financial crisis, this affected lowly and highly educated equally. Crisis-related economic conditions were not associated with widening health inequalities. Our results show that the unfavorable trends observed in the United States are not found in Europe. There has also been no discernible short-term impact of the crisis on health inequalities at the population level. Both findings suggest that European countries have been successful in avoiding an aggravation of health inequalities.

mortality | morbidity | health inequalities | Europe | financial crisis

**A**lthough reducing inequalities in health among socioeconomic groups has become a priority for policy-makers in many European countries, health inequalities have generally widened over the period from 1980 to the late 2000s (1–4). An update of these findings for the 2010s is urgently needed, for two reasons. The first is that unfavorable trends in mortality among the lowly educated have recently been reported from the United States (5). Since the early 2000s total mortality and self-reported morbidity have risen among middle-aged white Americans as a result of rising rates of suicide and poisonings, partly due to an epidemic of misuse of opioid painkiller drugs (6). These deaths have been labeled “deaths of despair,” because the increases in mortality were concentrated among the lowly educated who in the United States have experienced increasing economic and social disadvantage (7).

The second reason is that the impact of the 2008 financial crisis and its aftermath on health inequalities is unknown. The

crisis led to an economic recession with rising unemployment and fiscal austerity in most European countries, particularly in countries that had to be bailed out by the international community such as Greece, Cyprus, and Ireland (8). Because there were important differences among countries (*SI Appendix, Fig. S1*), there is ample scope for assessing the impact of the crisis. Previous recessions usually have had limited effects on population health, with increases in suicide and alcohol-related deaths and decreases in road-traffic fatalities (9). So far, the evidence for the latest recession is mixed: All-cause mortality has continued to decline, but suicide rates have risen, as have some other health problems in some of the countries that were severely hit, such as Greece, Spain, and Portugal (10). However, because the negative consequences of economic crises are likely to be borne primarily by the most disadvantaged, it is important to assess the health effects by socioeconomic group. Here again, the available evidence is scarce (11, 12).

## Significance

Inequalities in mortality and morbidity among socioeconomic groups are a highly persistent phenomenon despite having been the focus of public health policy in many countries. The United States has recently witnessed a widening of health inequalities due to rising mortality and morbidity among the lowly educated. Our study shows that, despite the financial crisis, most European countries have experienced an improvement in the health of the lowly educated in recent years. In Eastern Europe, this even represents a reversal as compared with previous decades. The 2008 financial crisis has had mixed effects without widening health inequalities. Our results suggest that European countries have been successful in avoiding an aggravation of health inequalities.

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The authors declare no conflict of interest.

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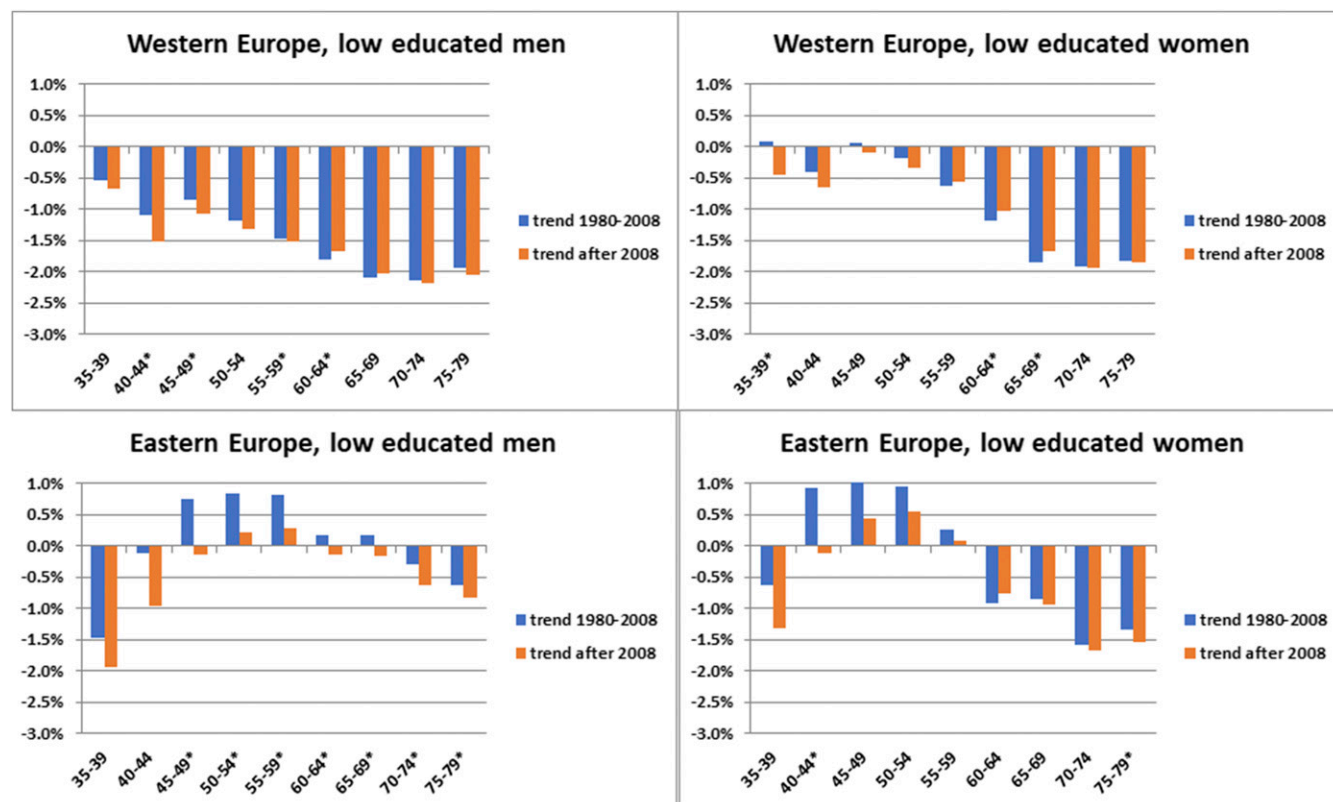
Data deposition: The aggregate data reported in this paper have been deposited in the institutional repository of Erasmus University Rotterdam (<http://hdl.handle.net/1765/106273>).

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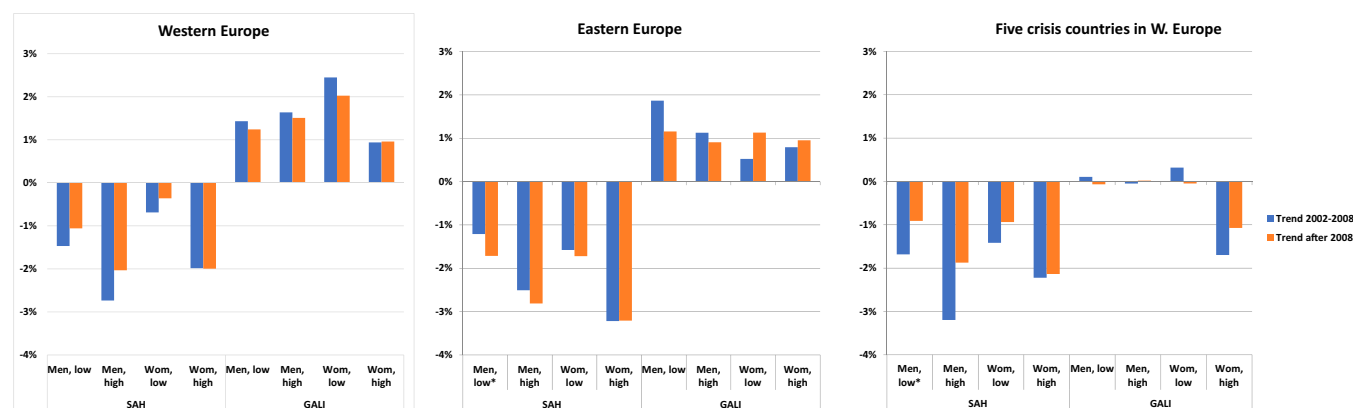
**Fig. 2.** Trends in age-specific mortality among lowly educated men and women between ca. 1980 and ca. 2008 and after ca. 2008, by region and sex. Graphs show average percent annual change in mortality as estimated in interrupted time-series analyses (the trend for 1980–2008 is based on  $\beta_1$ ; the trend after 2008 is based on  $\beta_1$  and  $\beta_2$ ; see *Materials and Methods* for details). Asterisks indicate statistically significant ( $P < 0.05$ ) differences between the two periods. For distinctions between Western and Eastern Europe, see *SI Appendix, Table S1*.

educated men, the gap in less-than-good SAH between lowly and highly educated men did not widen (*SI Appendix, Fig. S4*).

**Determinants of Trends in Mortality and Self-Reported Morbidity.** A more direct assessment of the impact of the crisis is provided by country and period fixed-effects analyses in which health outcomes are regressed on crisis-related economic variables (Table 1 and *SI Appendix, Table S7*). If the crisis had affected population

health, either directly or indirectly through the ensuing austerity measures, one would expect the economic indicators in Table 1 to be associated with mortality, SAH, and/or activity limitations. This is indeed the case, but not always in a direction indicating worse health and/or widening health inequalities as a result of the crisis.

National income was negatively associated with mortality, implying that stagnation of national income slowed the mortality decline. However, the effect was stronger among the highly



**Fig. 3.** Trends in less-than-good SAH and activity limitations among the lowly and highly educated between 2002 and 2008 and after 2008, by region and sex. Graphs show the average percent annual change in prevalence as estimated in interrupted time-series analysis (the trend for 1980–2008 is based on  $\beta_1$ ; the trend after 2008 is based on  $\beta_1$  and  $\beta_2$ ; see *Materials and Methods* for details). Asterisks indicate statistically significant ( $P < 0.05$ ) differences between the two periods. For distinctions between Western and Eastern Europe, see *SI Appendix, Table S3*. The five crisis countries in Western Europe were Ireland, Spain, Portugal, Greece, and Cyprus. GALI, global activity limitations indicator.





We consider the recent reversal of the mortality trend among the lowly educated in several Eastern European countries as our most remarkable finding. With the exception of Estonia (20), this has not been reported before, although favorable changes in national mortality trends have been noticed (21–23). Recent declines in mortality among the lowly educated in Eastern Europe are due to declines in mortality from smoking-related causes, causes amenable to medical care, and ischemic heart disease and sometimes also in mortality from alcohol-related causes and suicide (*SI Appendix, Fig. S5*). For the total population these changes have been attributed to a combination of long-term declines in smoking, improvements in health care, dietary changes, road-traffic safety measures, and alcohol control policies (23). Apparently, these mortality-lowering policies have finally also reached the lowly educated.

The facts that the 2008 crisis was short-lived in most Eastern European countries and that the European Commission supported massive investments in these countries' infrastructure may also have helped. However, despite the welcome trend reversal, levels of mortality among the lowly educated in Eastern Europe remain extremely high, and trends remain disappointing, particularly among the middle-aged (Figs. 1 and 2).

**Comparison with the United States.** Compared with the United States, trends in health inequalities have been more favorable in Western Europe, although declines in mortality among the lowly educated were slow among middle-aged men and were nearly absent among middle-aged women (Fig. 2). A detailed inspection of age-specific mortality trends by country revealed that no Western European country experienced the increases in mortality reported in the United States (6).

The latter have been attributed to a toxic mixture of greater socioeconomic inequalities, less comprehensive social security arrangements, a less accessible health care system, and the widespread availability of dangerous prescription drugs (7). Our results suggest that European health care systems may indeed play a role in constraining inequalities in mortality (Table 1). Equal relative effects of rising health care expenditure on mortality among lowly and highly educated groups imply larger absolute effects among the former and a narrowing of absolute inequalities in mortality when health care spending goes up—a finding that we have analyzed in more detail elsewhere (24). That we find no effects of out-of-pocket payments on mortality or self-reported morbidity (Table 1) suggests that rising out-of-pocket payments, which were part of austerity measures in several countries, have fortunately had limited effects on population health in most European countries.

**SAH and Activity Limitations.** It is easier to interpret our findings for mortality than those for self-reported health problems. Trends for SAH are somewhat similar to those for mortality, and it is tempting to invoke similar explanations, but whether these are valid remains to be seen.

For activity limitations, we confess our inability to explain the results. In individual-level analyses, activity limitations are associated with risk factors similar to those for mortality and SAH, including poverty and behavioral risk factors (25). However, in aggregate-level analyses we find deviant patterns, i.e., a rising prevalence which is stronger in countries with more rapidly rising national income.

One possible explanation is that the threshold for reporting activity limitations has become lower over time as a result of societal changes captured by rising national income, such as greater access to disability benefits (26). Another possibility is that rising life expectancy has come at the cost of an expansion of disability (27). Whatever the explanation, the general widening of inequalities in activity limitations, SAH, and mortality over time, particularly when measured at a relative scale, clearly

illustrates the frustratingly persistent nature of health inequalities in European welfare states.

**Strengths and Limitations.** This study provides a comprehensive and robust picture of trends in health inequalities in a large number of European countries. When we started our data collection in 2016, the most recent data available were for 2014, which implies that our study covers only a short period after the onset of the crisis in 2008. Also, mortality data for the early 2010s were available for only 11 countries. While this illustrates “the contrast between the substantial efforts expended by governments to collect up-to-the-minute financial data while health data lag by several years” (28), it also means that we are studying the short-term effects of the crisis.

Despite the near-absence of discernible short-term effects, the crisis may have negative long-term effects on health and health inequalities, for example through missed opportunities for economic advancement of young generations in countries with mass youth unemployment (29). Follow-up studies are therefore necessary to determine what the long-term impact of recession and austerity on health inequalities will be.

Mortality and to a lesser extent activity limitations often represent the end of a disease process that has taken years to unfold and therefore may not be particularly suitable for the detection of short-term effects. Measurement error, particularly in the case of activity limitations, which has not been fully harmonized in the European survey from which we have taken our data (the European Union Statistics on Income and Living Conditions, EU-SILC) (30), may also reduce sensitivity. On the other hand, our analysis also included outcome measures that may respond more immediately, such as mortality from causes amenable to medical care or injuries and SAH. The latter also captures mental health problems, for which health inequalities widened within a few years after the crisis in Spain (31).

We consider the combination of mortality with morbidity data a strength of our study, despite the fact that the morbidity measures were self-reported. Both between-country and within-country inequalities in self-reported morbidity may be distorted by differences in reporting styles (32–34). However, as our main focus is on changes occurring over relatively short time periods, we consider our results to be robust against these sources of bias.

Finally, although low education is a strong marker of social disadvantage, it is possible that the health effects of the crisis are concentrated in only a subgroup of the lowly educated or that vulnerability to these health effects is better captured by other social distinctions, such as occupational class, geographic location, or ethnicity. For example, in the United Kingdom the impact of public sector budget cuts has been felt most severely in deprived regions (35), and the full effects of the crisis therefore may not be detectable in national-level data.

## Conclusion

In contrast to the United States, and despite the occurrence of an economic crisis, the health of the lowly educated in Europe has improved in recent years, and health inequalities have sometimes narrowed.

## Materials and Methods

**Data.** We collected and harmonized register-based mortality data from 17 European countries. An overview of the mortality data sources and some key characteristics of the data are given in *SI Appendix, Table S1*. We also collected and harmonized data on self-reported health problems from two cross-national surveys: the European Social Survey (ESS), with biannual waves between 2002 and 2014, and the EU-SILC survey, with annual waves between 2004 and 2014. An overview of the survey data and some key characteristics are given in *SI Appendix, Table S3*. Together, these surveys cover 27 European countries. Both surveys include two single-item health questions: SAH (“How is your health in general”) and activity limitations (the

Global Activity Limitations Indicator: "For at least the past 6 mo, to what extent have you been limited in activities people usually do?"

Socioeconomic position was indicated by highest level of completed education with low, mid, and high corresponding to the International Standard Classification of Education (ISCED) 1997 categories 0–2, 3–4, and 5–6, respectively. We focused on educational inequalities (instead of, e.g., occupational inequalities) primarily because comparable data on educational attainment were available for both mortality and survey data in all European populations under study. Education is also the most stable measure of socioeconomic position because it is normally completed early in adulthood, which avoids most problems of reverse causation (36). The analyses were restricted to persons 35–79 y of age because education gradually loses its discriminatory power as a measure of socioeconomic status among the elderly.

For our analysis of the determinants of trends in health inequalities we extracted six indicators of economic recession and/or the policy response to the financial crisis: national income [Gross Domestic Product (GDP)], unemployment (unemployed as percentage of the labor force), material deprivation (inability to pay for at least three of nine items), social transfers (social security transfers as a percentage of GDP), health care expenditure (current expenditure on health as a percentage of GDP), and out-of-pocket payments for health (as a percentage of total health expenditure). With the exception of the poverty indicators, which were available by sex and education and only for the period 2004–2014, all these variables represent yearly national averages for the period 1980–2014.

**Methods.** The mortality and self-reported morbidity rates by sex and educational level were directly age-standardized using the European Standard

Population. We studied changes in the magnitude of both relative and absolute inequalities, using both simple measures [rate ratios (RR) and rate differences (RD)] and more complex (RII and SII), which take into account all education groups as well as each education group's share in the total population and therefore provide adjustment for changes in educational composition over time (13).

To quantify changes over time in mortality and self-reported morbidity and to assess whether a recent change in trend has occurred, we conducted interrupted time-series analyses in which mortality and self-reported morbidity were modeled as a function of time, including a possible change in trend after 2008. To more directly analyze the association between changes over time in health outcomes and the crisis, we conducted panel (or pooled cross-sectional time-series) analyses in which health outcomes were modeled as a function of crisis-related economic variables using country and period fixed effects. For more details on the analysis, see *SI Appendix, Box S1*.

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